

Hitachi Debugging Interface Evaluation Module

**HDI for LEM3664
Low cost evaluation module for H8 Tiny Series of
Microcontrollers**

User Manual

Version 2.0
August 2002

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1 Introduction

The LEM is a low cost evaluation module for the 3664, 3664N, 3672, 3687 and 3694 members of the Hitachi H8 Tiny family of microcontrollers. This manual describes the functions supported by the evaluation module for HDI, for use with these microcontrollers.

Abbreviations

In this manual the following abbreviations will be used:

HDI	-	Hitachi Debugging Interface
HLL	-	High Level Language
LEM	-	Low Cost Evaluation Module

Features

HDI provides C level debugging for targets that use the E10T interface and firmware. The following main features are supported by HDI:

- Flash programming of user code ¹
- Real-time program execution
- Program download
- Program Counter breakpoints
- Step, step over, step out, and go functions
- Memory set, verify, fill, verify fill, query
- Register functions
- Trace buffering

¹ The LEM3664 is not designed for use as a production programmer and therefore should not be used in such a manner.

Overview

The target hardware LEM3664 board for HDI has the main hardware components, as shown below.

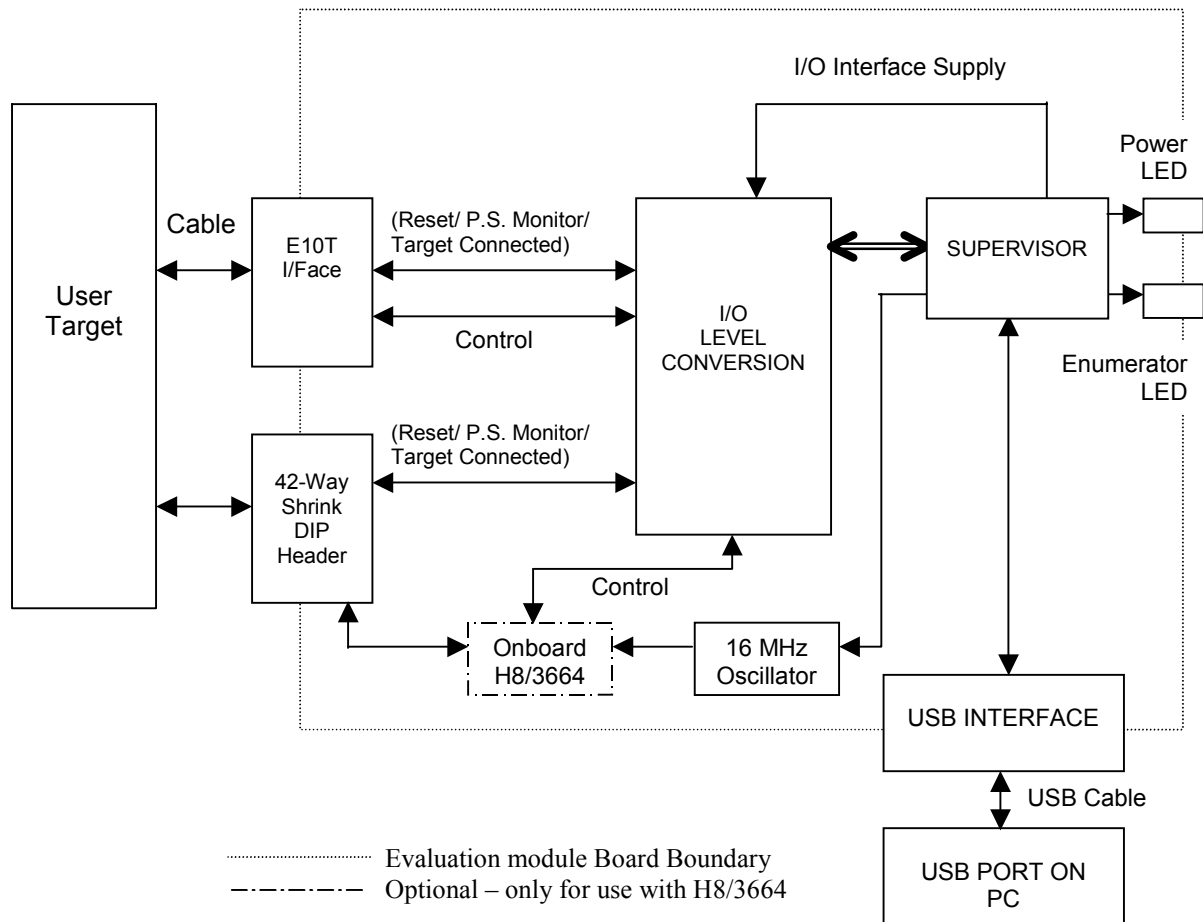


Figure 1: LEM3664

The evaluation module has one USB port, one E10T Interface and one 42-pin SDIP header. The USB port is connected to the corresponding port on the PC, using a standard USB cable, supplied with the evaluation module. The E10T interface enables connection to the target system using the supplied cable. The 42-pin SDIP header enables direct connection to the target system PCB.

2 Installation

System Requirements

Hardware

The minimum hardware configuration, required to install HDI with the LEM3664, is as follows:

- IBM PC or 100% compatible with a 486 or better. A Pentium processor is recommended
- 1 free USB port
- 32 MB or more of memory
- Mouse (recommended)
- VGA monitor
- 80 MB of hard disk space
- CD-ROM Drive to install the tools and tutorial files

Software

The operating system for the PC to which the evaluation module will be connected, must be one of the following:

- Windows 98
- Windows ME
- Windows 2000
- Windows XP

System Specification

MCU Operating Modes

The H8 Tiny series of microcontrollers have a single mode of operation, supporting a 64 KByte address space.

H8/3664 and 3664N Memory Map

H'0000	Vector Area
H'0400	Monitor Code
H'0800	Free Flash
H'7FFF	
H'F780	Monitor Stack/Data
H'FB80	On chip RAM (1 KByte)
H'FF80	Internal I/O Registers
H'FFFF	End Of Memory

Figure 2: H8/3664 Memory Map

H8/3672 Memory Map

H'0000	Vector Area
H'0400	Monitor Code
H'0800	Free Flash
H'3FFF	
H'F780	Monitor Stack/Data
H'FB80	On chip RAM (1 KByte)
H'FF80	Internal I/O Registers
H'FFFF	End Of Memory

Figure 3: H8/3672 Memory Map

H8/3687 Memory Map

H'0000	Vector Area
H'0400	Monitor Code
H'0800	Free Flash
H'DFFF	
H'E800	On Chip RAM
H'FFFF	
H'F700	I/O Registers
H'F77F	Monitor Stack/Data
H'FB80	On chip RAM (1 KByte)
H'FF80	Internal I/O Registers
H'FFFF	End Of Memory

Figure 4: H8/3687 Memory Map

H8/3694 Memory Map

H'0000	Vector Area
H'0400	Monitor Code
H'0800	Free Flash
H'7FFF	
H'F730	I/O Registers
H'F74F	Monitor Stack/Data
H'FB80	On chip RAM (1 KByte)
H'FF80	Internal I/O Registers
H'FFFF	End Of Memory

Figure 5: H8/3694 Memory Map

Hardware Installation

The procedure for hardware installation is dependant on whether you are connecting the low cost evaluation module to a target system using the external E10T interface or the internal 42-pin SDIP header.

If you are connecting the evaluation module to a target system using the external E10T interface, use the following procedure:

1. Ensure the target board has a 14-way interface compatible with the 0.1" pitch E10T – Tiny interface header cable used by the LEM3664. 4K7 pull-up resistors are recommended on each of the five signals to the H8/Tiny device. The specification of this interface (serial directions with reference to the target system) is described in the following table:

<i>Pin</i>	<i>Function</i>	<i>Description</i>	<i>3664F/N, 3687F, 3694F Pin</i>	<i>3672F</i>	<i>Pin</i>	<i>Function</i>	<i>Description</i>	<i>3664F/N, 3687F, 3694F & 3672F Pin</i>
1	SCK	Serial Clock	P8_7	E10_2	2	GND	Ground	Vss
3	NC	(Gnd on LEM)	-	-	4	GND	Ground	Vss
5	TXD	Serial Transmit	P8_6	E10_1	6	GND	Ground	Vss
7	NMIn	Target NMIn	NMIn	NMIn	8	UVCC	Detect target supply voltage	Vcc
9	NC	(Gnd on LEM)	-	-	10	GND	Ground	Vss
11	RXD	Serial Receive	P8_5	E10_0	12	GND	Ground	Vss
13	RESETn	Target RESETn	RESn	RESn	14	UCONNECT	Detect whether target connected	Vss

Table 1: Pin Assignment for the E10T - Tiny Interface

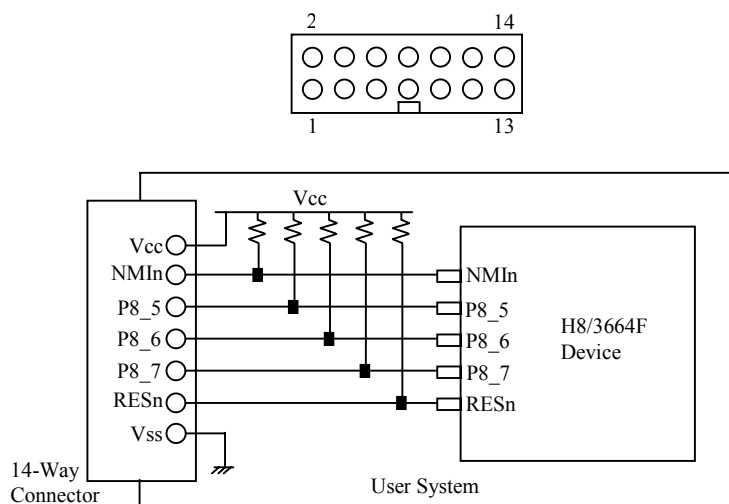


Diagram 1: Pin Numbering of Connector on User's System and Example Pull-up Resistor Diagram

2. Ensure that pin 14 (UCONNECT) is connected to GND on the target board.
3. Plug one end of the supplied cable into the E10T interface on the LEM3664.
4. Plug the other end of the supplied cable into a compatible E10T interface on the target board.

If you are connecting the evaluation module to a target system using the internal 42-pin SDIP header, please note the following:

- The PDIP header is supplied as part of the package for end user fitting.
- Once the PDIP header has been connected, the LEM3664 circuit board cannot be refitted into its original case. This is to comply with the requirements of CE conformity.
- Ensure that the target board does not foul the underside of the LEM3664 circuit board.
- The TEST pin on the PDIP header must be connected to GND.

The procedure for connecting the internal 42-pin SDIP header to a target system is as follows:

1. Remove the cover of the LEM3664 by gently prising the two case sections apart. This may be achieved by inserting a flat blade screwdriver into the holes located at each end of the case.
2. Solder the supplied PDIP header to the circuit board.
3. Connect the LEM3664 evaluation module to the target board using the 42-way PDIP header, ensuring that the TEST pin is connected to GND.

Software Installation

Software Components

The different software components are:

Hitachi Embedded Workshop

Hitachi Debugging Interface for the LEM3664

CodeLines for the LEM3664

Software Installation Overview

It is recommended that the following installation sequence be followed:

1. Installation of Hitachi Embedded Workshop
2. Installation of HDI3664
3. Installation of CodeLines 3664
4. Optional installation of Adobe® Acrobat Reader®

Note:

The USB driver is installed along with the installation of HDI3664. It is recommended that the LEM3664 module is not plugged in until the HDI3664 software has been installed.

Installation of Hitachi Embedded Workshop

1. Insert the LEM3664 Software Tools CD-ROM. After a few moments the following window is displayed:

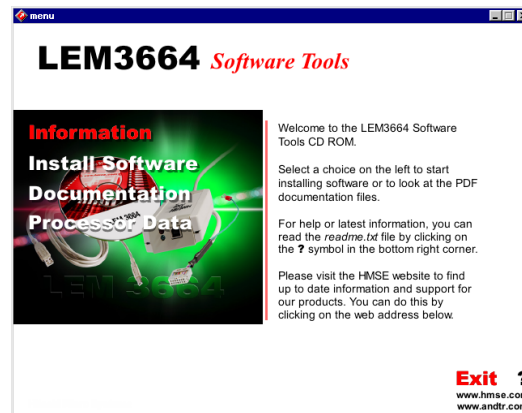


Figure 6: LEM3664 Software Tools Welcome

If this screen does not display automatically, launch the MENU.EXE program located in the root folder of the CD-ROM.

2. Click **Install Software**. The following window is displayed:

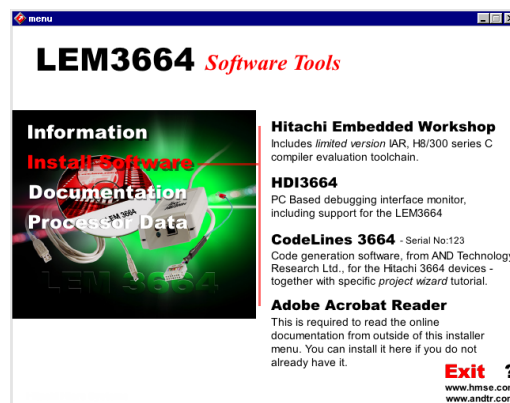


Figure 7: LEM3664 Software Tools Installation Choices

3. Click Hitachi Embedded Workshop. The following window is displayed:

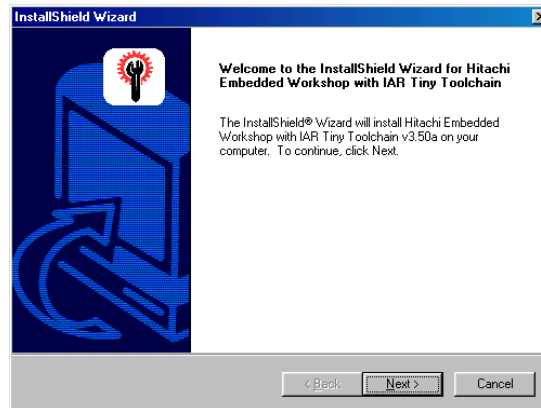


Figure 8: Installation Welcome screen

4. Click the Next button. The following window is displayed:



Figure 9: Software License Agreement

- Click the Yes button to indicate your agreement to the Software License Agreement. The following window is displayed:

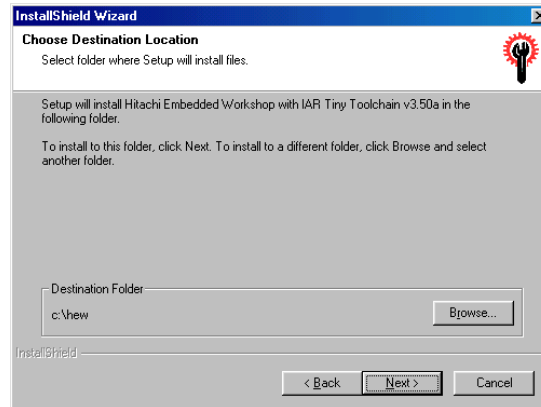


Figure 10: Choose Destination Location

- Click the Next button. The following window is displayed:

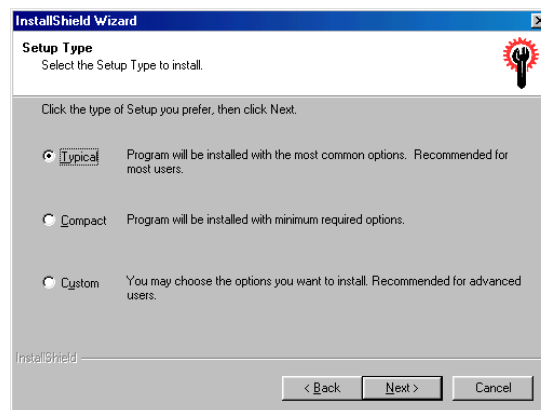


Figure 11: Choose Setup Type

7. Leave the Typical option selected and click the Next button. The following window is displayed:

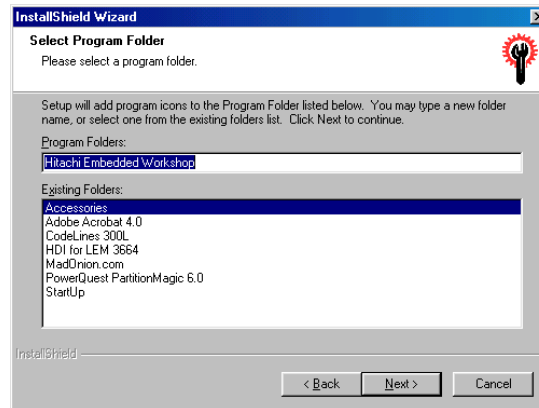


Figure 12: Select Program Folder

8. Click the Next button to continue. The following window is displayed:

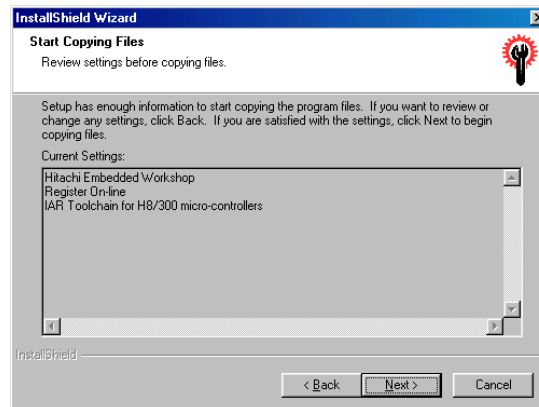


Figure 13: Start Copying Files

9. Click the Next button. File will be copied from the CD-ROM. After a few moments the following window will be displayed:

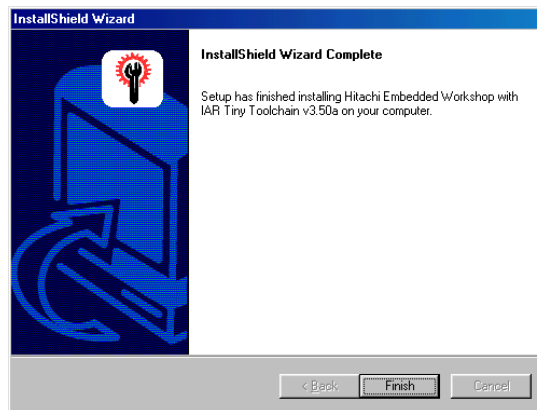


Figure 14: Setup Complete

10. Click the Finish button to return to the LEM3664 Software Tools window.

Installation of HDI3664

1. Click the HDI3664 option on the LEM3664 Software Tools window. The following window is displayed:

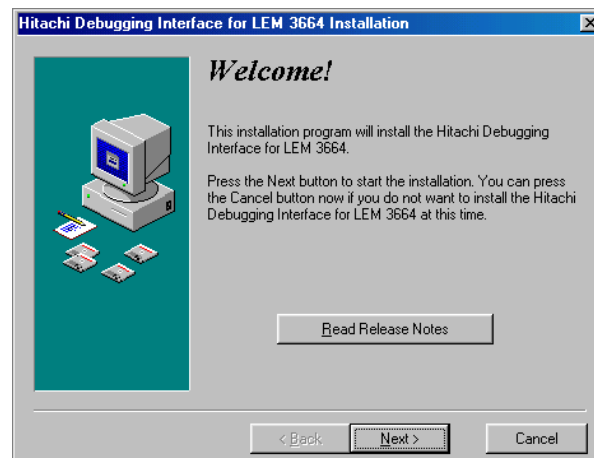


Figure 15: HDI3664 Welcome Screen

2. To read the release notes, click the Read Release Notes button, otherwise, click the Next button. The following window is displayed:

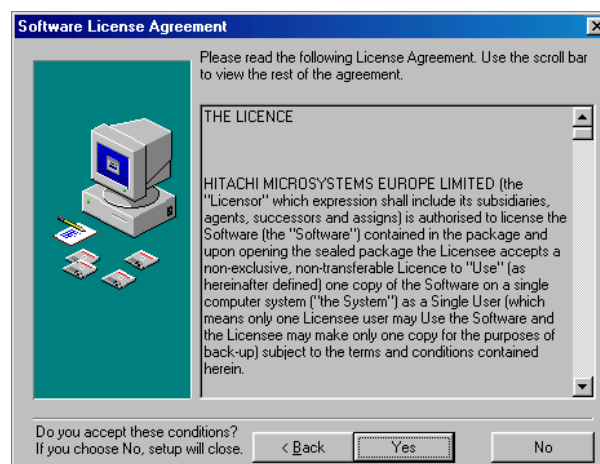


Figure 16: Software License Agreement

- Click the Next button to indicate your agreement to the Software License Agreement. The following window is displayed:

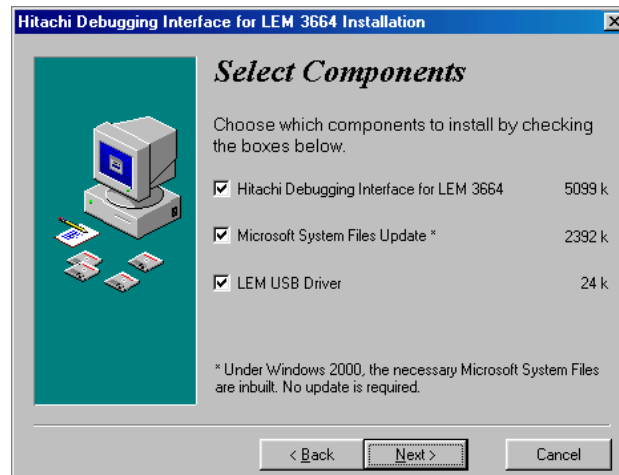


Figure 17: Select Components

- Click the Next button to install all the components. The following window is displayed:

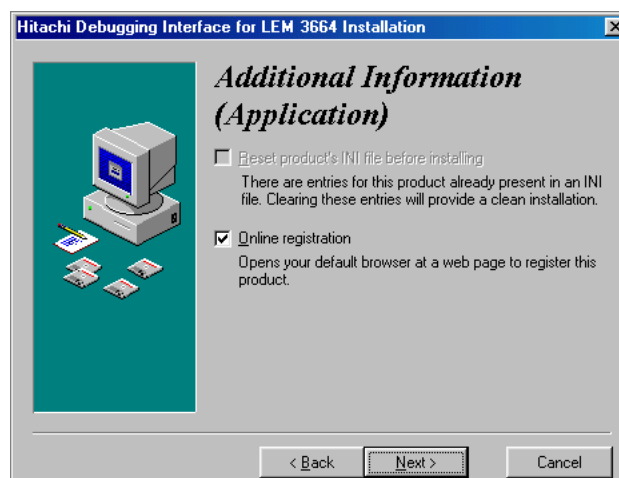


Figure 18: Additional Information

5. Click the Next button to accept the default choices. The following window is displayed:

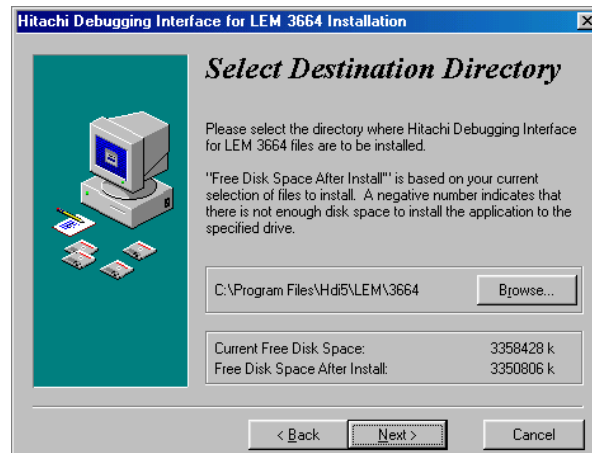


Figure 19: Select Destination Directory

6. Click the Next button to accept the default installation directory. The following window is displayed:

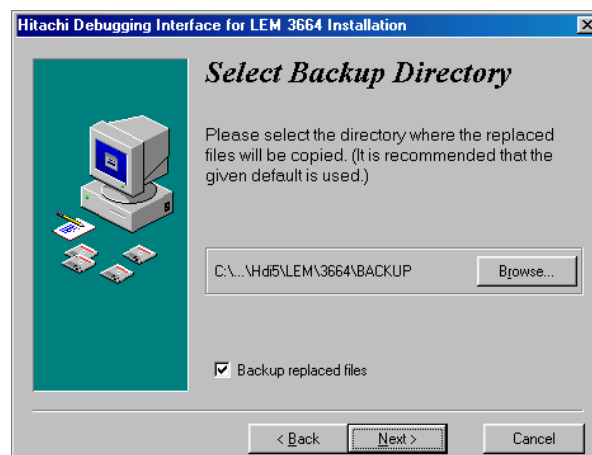


Figure 20: Select Backup Directory

7. Click Next to accept the default backup directory. The following window is displayed:

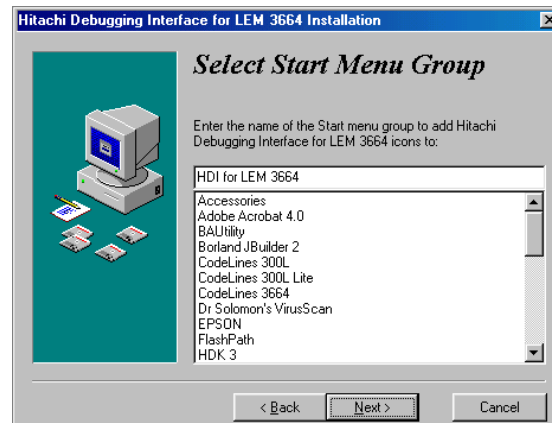


Figure 21: Select Start Menu Group

8. Click the Next button to accept the default Start menu group. The following window is displayed:

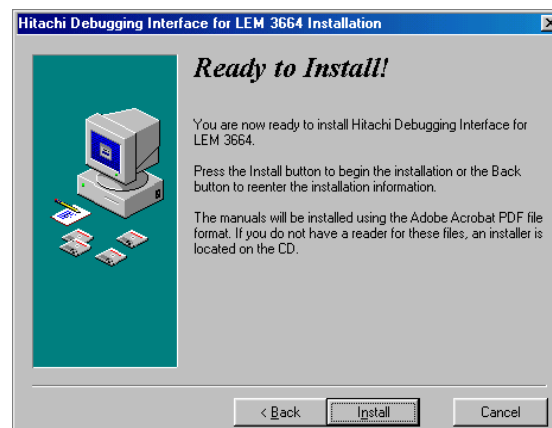


Figure 22: Ready to Install!

9. Click the Install button to proceed with the installation.

10. If you installing on a Windows 9X platform, the following window may be displayed:



Figure 23: USB Adapter Not Found

11. Click the OK button. After file copying is complete, the following window is displayed:

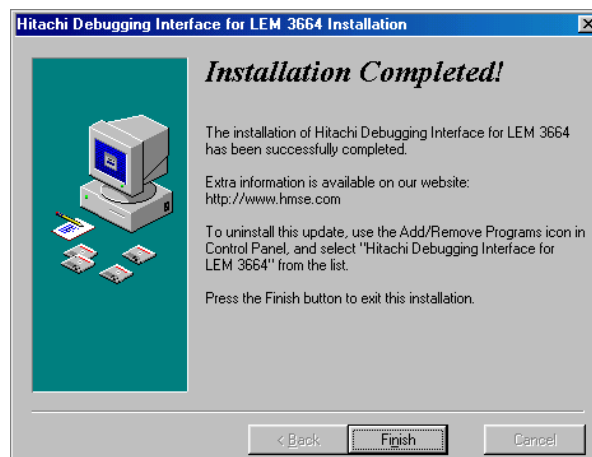


Figure 24: Installation Completed!

12. Click the Finish button to return to the LEM3664 Software Tools window.

Installation of CodeLines 3664

1. Click the CodeLines 3664 option on the LEM3664 Software Tools window. The following window is displayed:

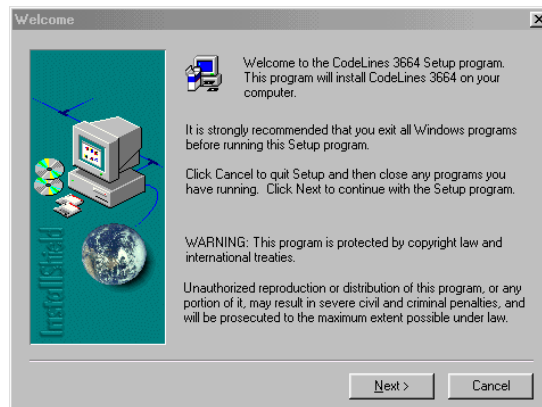


Figure 25: CodeLines 3664 Welcome Screen

2. Click the Next button. The following window is displayed:

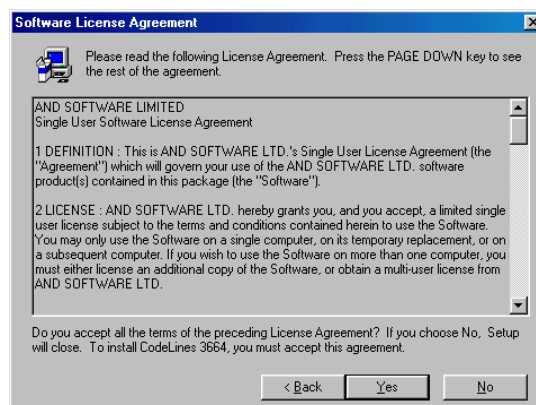


Figure 26: Software License Agreement

3. Click the Yes button to indicate your agreement to the Software License Agreement. The following window is displayed:

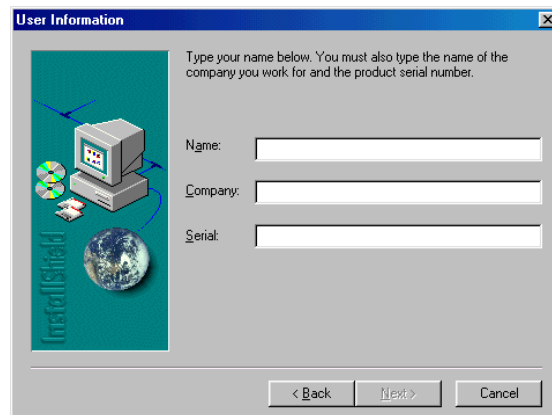


Figure 27: User Information

4. Type your name, company name and product serial number. You may type any alphanumeric sequence for the serial number.
5. Click the Next button. The following window is displayed:

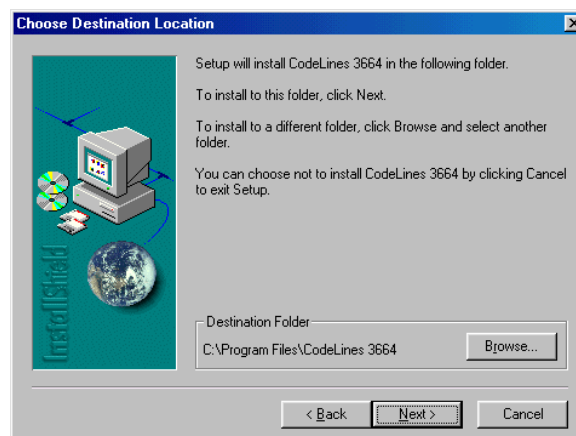


Figure 28: Choose Destination Location

6. Click the Next button to accept the default destination location. The following window is displayed:

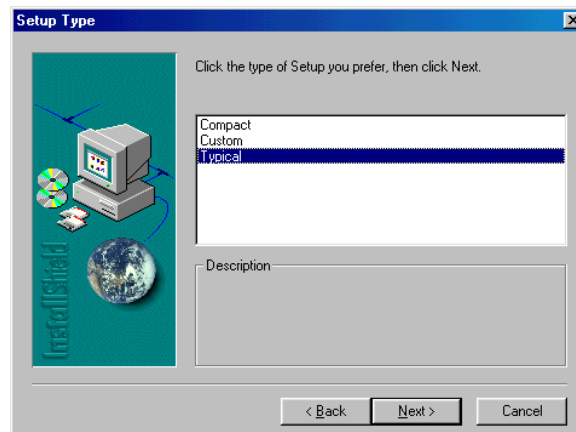


Figure 29: Setup Type

7. Click the Next button to select a Typical setup type. The following window is displayed:

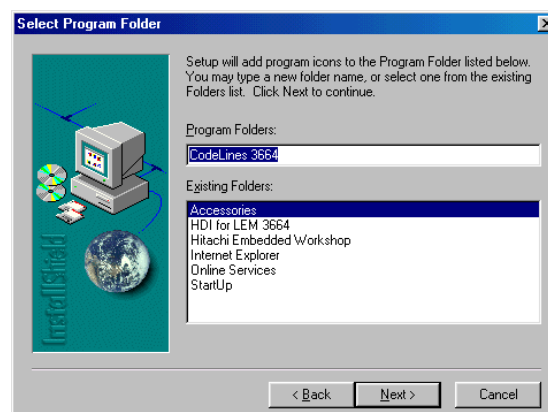


Figure 30: Select Program Folder

8. Click the Next button to accept the default program folder name.
9. The necessary files will be copied from the CD-ROM.

10. When Setup has completed the installation, the following window is displayed:

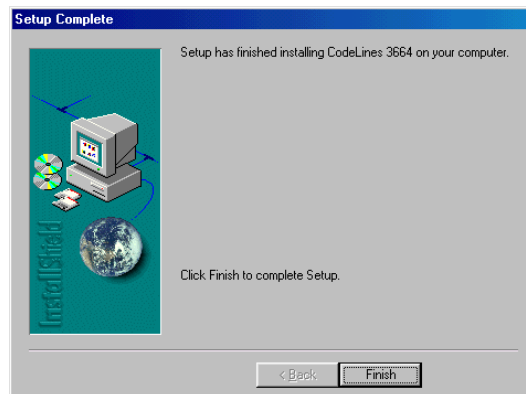


Figure 31: Setup Complete

11. Click the Finish button to return to the LEM3664 Software Tools window.

Installation of Adobe® Acrobat Reader®

Product documentation is supplied as PDF files, requiring Adobe® Acrobat® Reader to be installed on your computer. If you do not already have this program installed on your computer, complete the following steps:

1. Click the Adobe® Acrobat® Reader option on the LEM3664 Software Tools window. The following window is displayed:



Figure 32: Acrobat Reader 5.0 Setup

2. Click the Next button. The following window is displayed:

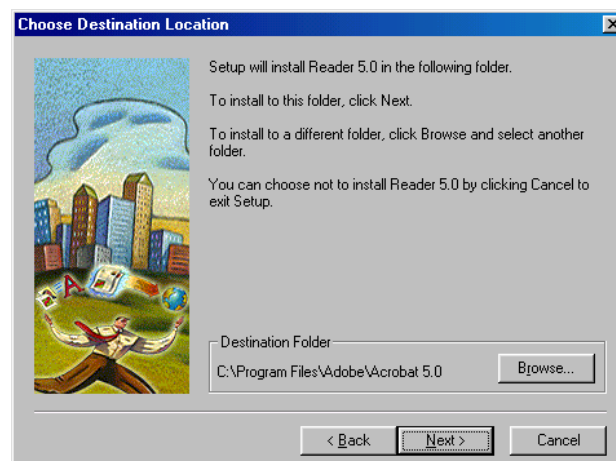


Figure 33: Choose Destination Location

3. Click the Next button to accept the default destination location.

4. The necessary files will be copied from the CD-ROM. When installation is complete the following window is displayed:

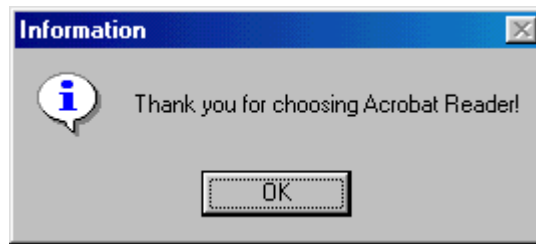


Figure 34: Thank You For Choosing Acrobat Reader!

5. Click the OK button to return to the LEM3664 Software Tools window.
6. Select the Exit option to close the LEM3664 Software Tools window.

3 LEM Functions

All monitor functions are accessed through the HDI graphical user interface.

Program Download

The monitor provides HLL debugging capability for the IAR and Hitachi compilers, which support UBROF V5.0 objects, SYSROF V1.0 and V2.0 objects, and COFF format without stabs, respectively.

Program Counter Breakpoint

A maximum of 256 breakpoints is supported.

Execution Functions

The different execution modes provided are:

- Execute
 1. Run mode
 2. Step mode
 - a) Step in
 - b) Step over
 - c) Step out
- Stop

Memory Functions

Memory supporting commands are:

- General memory set functions
- Memory query
- Memory get
- Fill, verify and verify fill

Register Functions

The LEM provides functions that allow retrieval of a CPU register, or retrieval of all the CPU registers.

Register supporting commands perform:

- Request register block values
- Request single byte register
- Request single long word register

Trace Buffer

The LEM can capture up to four levels of program branch. Intermediate instructions are filled from a program disassembly between program branches.

Other Functions

Further commands supported are:

- Definition of LEM capabilities
- Read/Write I/O register

4 User Program Considerations

The following gives details on the restrictions placed on the user program due to the operation of the low cost evaluation module.

Interrupts and Exceptions

Interrupts Used by the Evaluation Module

The evaluation module uses several interrupts to communicate with the host PC, and control user program execution. The following table lists the interrupts reserved by the evaluation module:

<i>Vector Number</i>	<i>Vector address</i>
1	H'02 to H'03
2	H'04 to H'05
3	H'06 to H'07
7*	H'0E to H'0F
12	H'18 to H'19
20	H'28 to H'29

Table 2: Interrupts used by the Evaluation module

*Vector 7 is the NMI vector and is utilised in the following two ways:

- It is enabled under supervisor control and is used to break out of the user program when it is executing.
- It is used by the evaluation module firmware to control execution of the user program and to report evaluation module status.
- SCI4 (serial communication interface channel 4) is used by the evaluation module firmware to communicate with the host, via port pins P87, P86 and P85.

Other Considerations

Standby Modes

The evaluation tool is unable to determine which the mode the microcontroller is in, i.e. whether the microcontroller is in sleep, standby or sub-sleep mode.

5 Tutorial

This section of the manual will guide you through an example project building, compiling and debugging session and show the major features the evaluation module provides, in conjunction with the HDI. When you have completed this tutorial you will be able to perform most operations necessary to debug your application. For a complete description of all standard features available, please refer to the “Hitachi Debugging Interface - User Manual”.

If you are not using the 3664, then select an alternative timer from the table below:

If your microcontroller is not included in this table, then no CodeLines exists for this type and you will not be able to complete the CodeLines section of the tutorial. Instead, the necessary source code is included on the LEM3664 CD-ROM.

Using CodeLines to Create a Project

1. Launch CodeLines by clicking Start → Programs → CodeLines 3664 → CodeLines 3664. The following window is displayed:

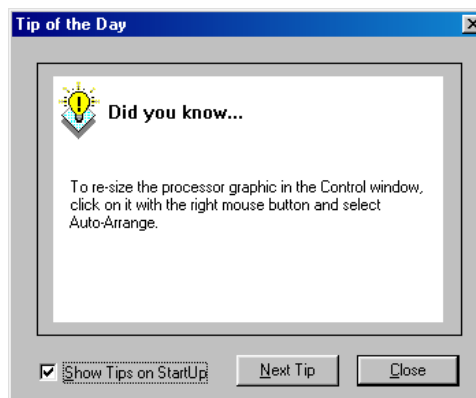


Figure 35: Tip Of The Day

2. Click the Close button. The following window is displayed:

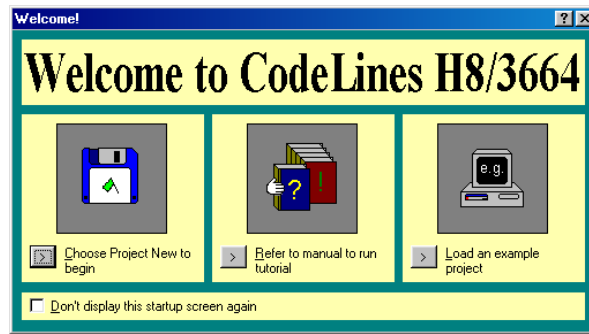


Figure 36: CodeLines H8/3664 Startup Screen

3. Close this window.
4. Select the **[Project -> Project Wizard]** menu item. The following window is displayed:

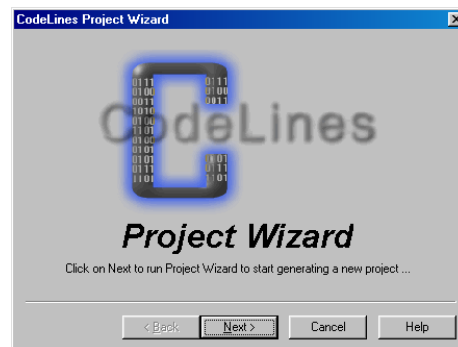


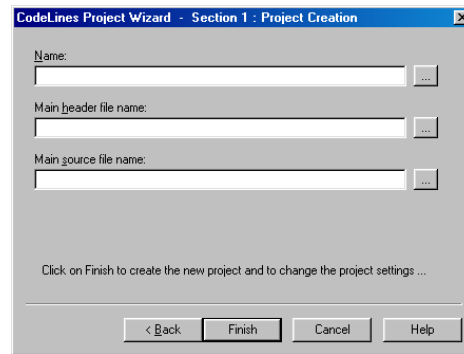
Figure 37: CodeLines Project Wizard

5. Click the Next button. The following window is displayed:



Figure 38: CodeLines Project Wizard - Project Creation

6. Click the Next button. The following window is displayed:



The image shows a Windows-style dialog box titled "CodeLines Project Wizard - Section 1 : Project Creation". It contains three input fields, each with a "..." button to its right: "Name:", "Main header file name:", and "Main source file name:". Below these fields is a line of text: "Click on Finish to create the new project and to change the project settings ...". At the bottom of the dialog are four buttons: "< Back", "Finish", "Cancel", and "Help".

Figure 39: Project, Header File and Source File Names

- Click the following button to display the Browse dialog box:



- Navigate to the root of your C: drive. Click the following button to create a new folder:



- For the folder name, type **LEM3664 Project**. Double-click this newly created folder to open it.
- In the File name field, type **tutor**
- Click the Open button. The CodeLines Project Wizard dialog box will be re-displayed:

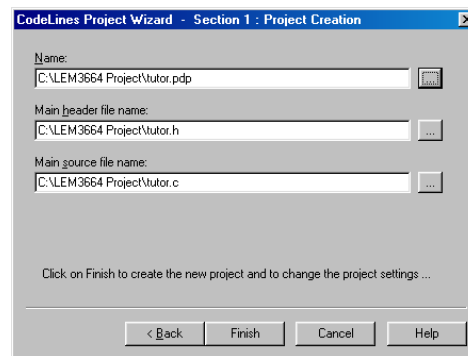


Figure 40: Displaying Project, Header File and Source File Names

- Click Finish. The following window is displayed:

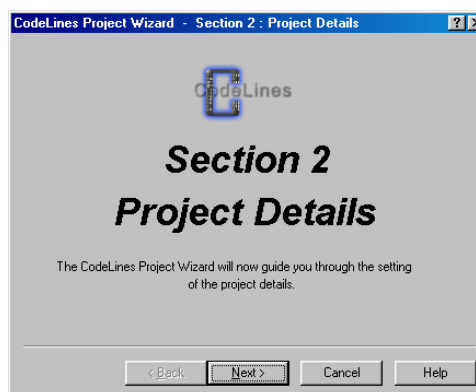


Figure 41: Project Details

13. Click the Next button. The following window is displayed:

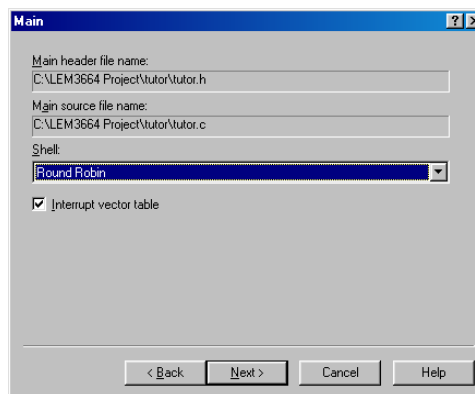


Figure 42: Project Details – Main Options

14. Click the Next button. The following window is displayed:

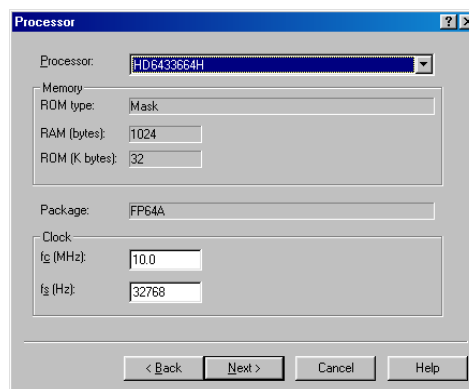


Figure 43: Project Details - Processor Options

15. For the **Processor**, select **HD64F3664BP**. Change the **Clock (fc)** frequency to **16.0 MHz**.

16. Click the Next button. The following window is displayed:

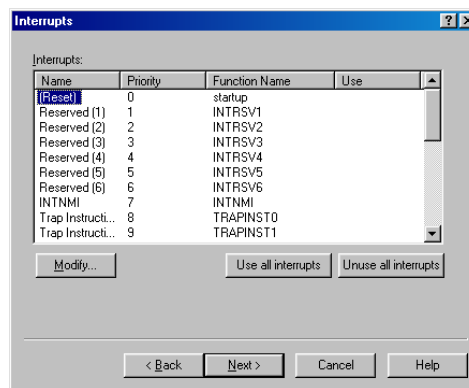


Figure 44: Project Details - Interrupts

Click the Next button. The following window is displayed:

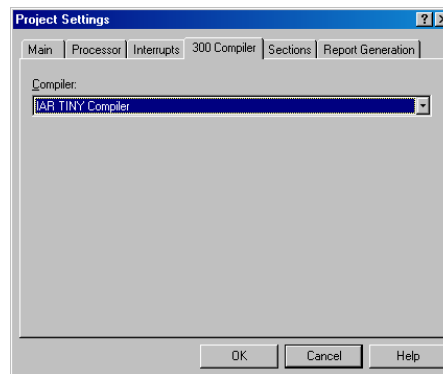


Figure 45: Project Details - 300 Compiler Selection

17. Select the IAR TINY compiler and click the Next button. The following window is displayed:

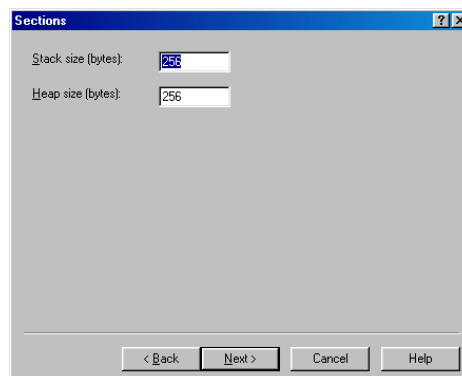


Figure 46: Project Details - Stack and Heap Sizes

18. Change the **Stack size** to **64 bytes** and the **Heap size** to **32 bytes**.
19. Click the Next button. The following window is displayed:

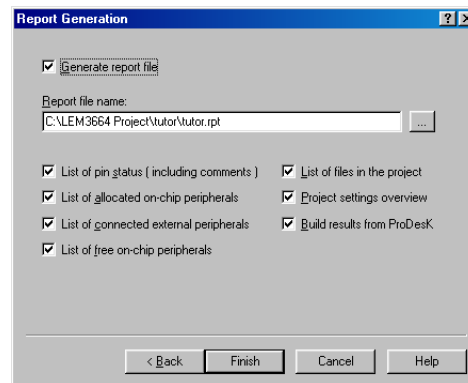


Figure 47: Project Details - Report Generation Options

20. Click the Finish button. The following window is displayed:

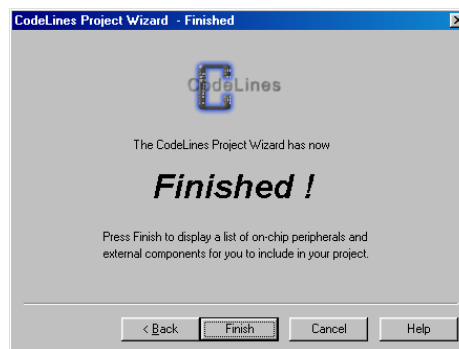


Figure 48: CodeLines Project Wizard Has Finished!

21. Click the Finish button. The Control, On-chip Peripherals and External Components windows will be displayed:

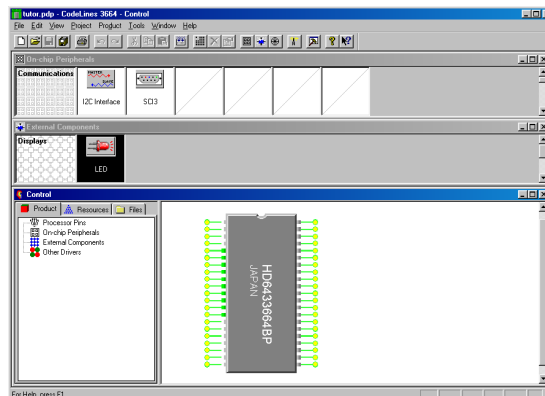


Figure 49: CodeLines Control. On-Chip Peripherals and External Components Windows

22. In the On-chip Peripherals window, locate the **Timers** section and double-click **Timer V**.
23. Click the **Pulse Output** tab. The following window is displayed:

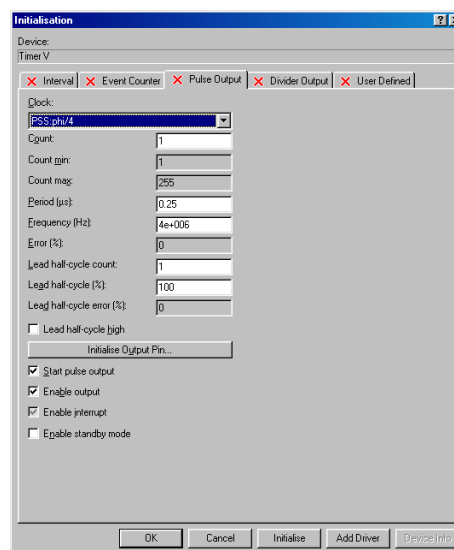


Figure 50: Initialisation of the Pulse Output for Timer V

24. Click the **Add Driver** button. The following window is displayed:

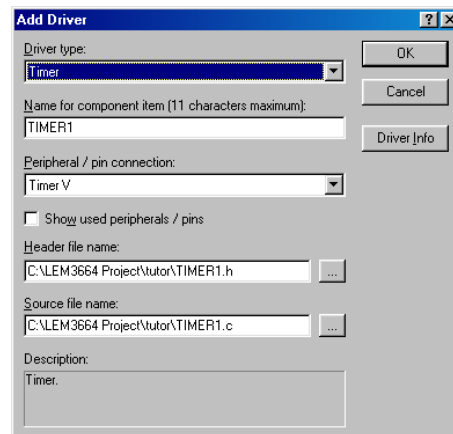


Figure 51: The Add Driver Dialog Box

25. From the **Driver type** list, select **Pulse Output**. The following window is displayed:

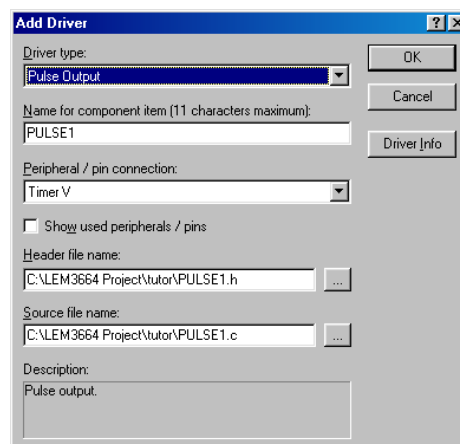


Figure 52: Adding the Pulse Output Driver

26. Change the **Name for component item** to **PulseOutput**.

27. Click the OK button. The following window is displayed:

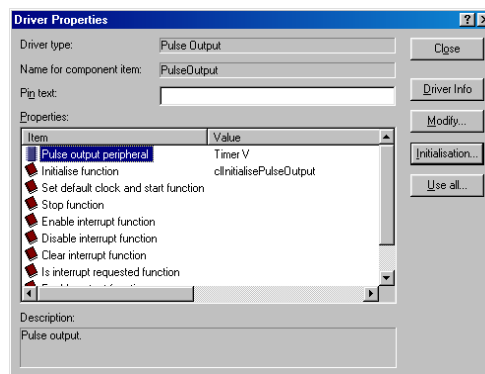


Figure 53: Pulse Output Driver Properties Dialog Box

28. Click the Use all... button, then double-click Pulse output peripheral. The following window is displayed:

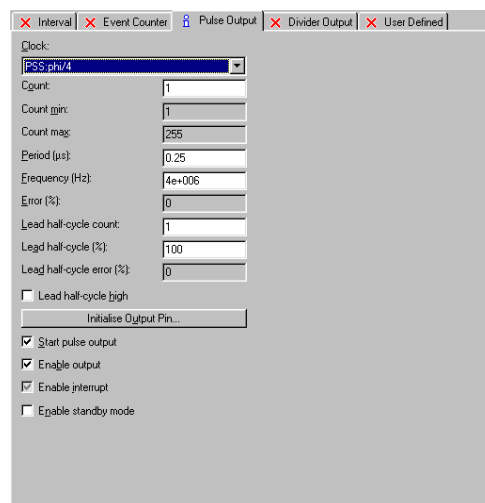


Figure 54: Changing Pulse Output Properties

29. Change the **Frequency** to **1000 Hz**.
30. Change the **Lead half-cycle** to **10%**.
31. Select **Lead half-cycle high**.

32. Click the Initialise Output Pin button. The following window is displayed:

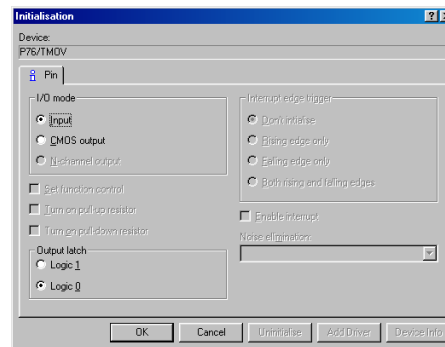


Figure 55: Initialisation of Output Pin

33. Change the **I/O mode** to **CMOS output**. Change the **Output latch** to **Logic 1**. Click the OK button.
34. Clear the Enable interrupt tick box. Click the OK button.
35. The Driver Properties dialog box will be re-displayed.
36. For the pin text type **Pulse**
37. Click the Close button.
38. Select the [**Project -> Build**] menu item.
39. The project will be built, with the results of the build being displayed in the Output window:

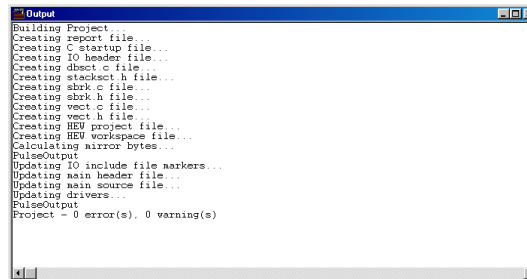


Figure 56: Project Build Results

Using Hitachi Embedded Workshop to Compile and Link the Project

1. From CodeLines, select the [**Tools -> Compiler IDE**] menu item to launch the Hitachi Embedded Workshop, or launch Hitachi Embedded Workshop from your Start menu. The following window is displayed:

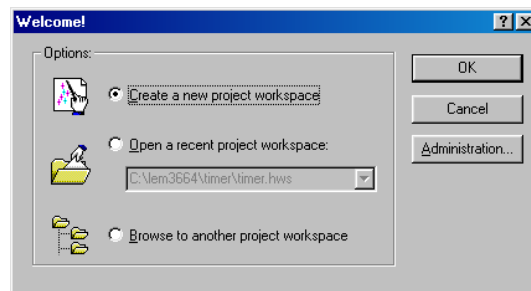


Figure 57: HEW Welcome Screen

2. Select **Browse to another project workspace** and click OK. The following window is displayed:

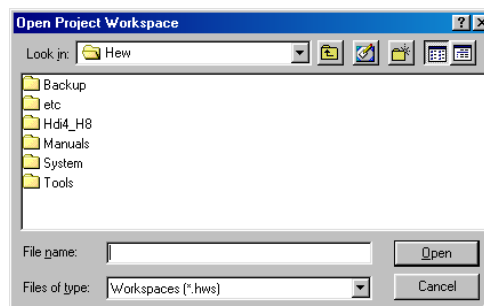


Figure 58: Open Project Workspace

3. Browse to the C:\LEM3664 Project folder and double-click the tutor folder.

4. Select the tutor workspace and click the Open button. The following window is displayed:

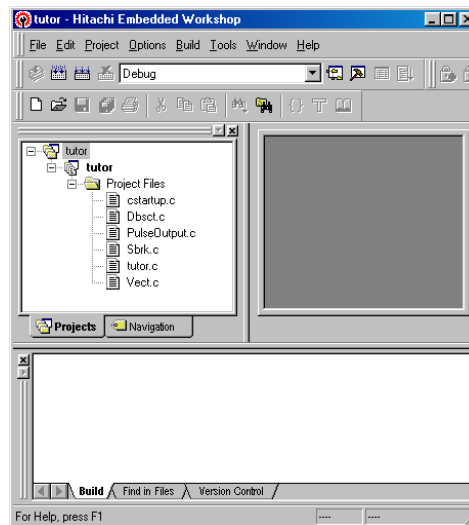


Figure 59: Displaying the Tutorial Workspace

5. Select the [**Build -> Build All**] menu item. The results of the build will be displayed:

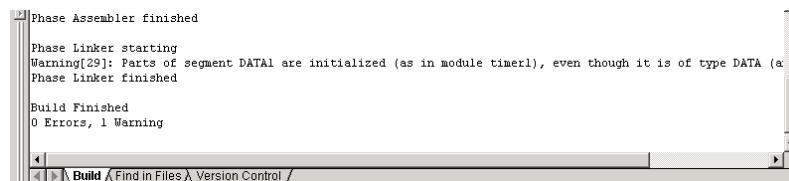


Figure 60: Build Results Window

6. Note a warning may be displayed. This is normal.
7. Close the Hitachi Embedded Workshop program and the CodeLines program.

Connecting the Evaluation Module

Connect the evaluation module to the PC using the supplied USB cable. Both red and green LEDs will illuminate, the red LED indicating that the evaluation module is receiving power and the green LED indicating that enumeration is taking place.

Starting HDI

1. To invoke HDI, click Start → Programs → HDI for LEM 3664 → Hitachi Debugging Interface for LEM 3664. The HDI window will open.
2. The following dialog box is displayed:

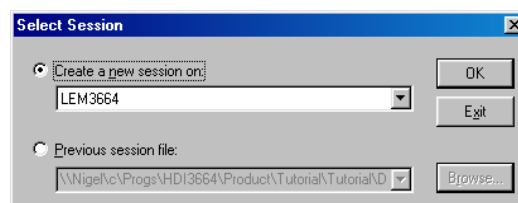


Figure 61: Select Session

3. Click the OK button. The following window is displayed:

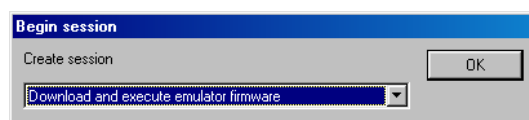


Figure 62: Create a New Session

4. Two options are available on this dialog box:



Figure 63: New Session Options

5. For the purposes of this tutorial, select Download and execute emulator firmware (the default option).

System Configuration

1. After you have selected the Download and execute emulator firmware option from the Begin session dialog box, the following dialog box is displayed:

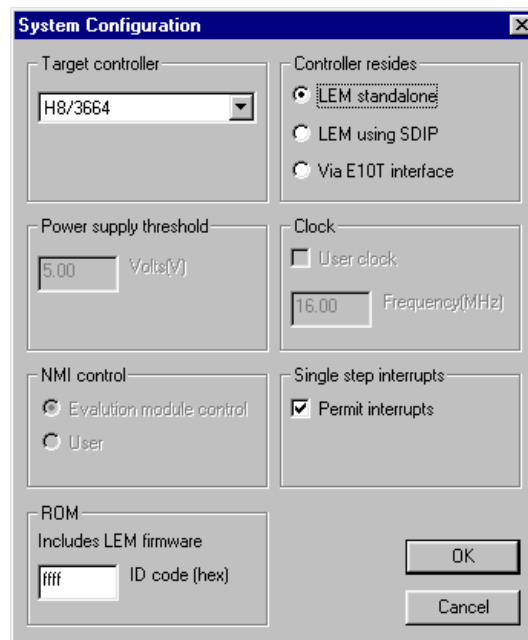


Figure 64: System Configuration Dialog Box

Note that some options will not be available, depending on the chosen settings for the Target controller and Controller resides sections. Clicking one of the following radio buttons causes certain options in the dialog box to become selectable:

- LEM standalone
- LEM using SDIP
- Via E10T interface

The following table lists each option and the circumstances for which it is available.

Item	Description
Power supply threshold	Specify the voltage to be used. Unavailable using LEM in standalone mode.
Clock	Select whether user clock source used and if so, its frequency. Unavailable if in standalone mode. User clock source mandatory if using E10T interface, optional if using SDIP

	interface.
NMI control	Select whether the NMI is controlled by evaluation module or user hardware.
ROM	ID code to 'unlock' access to the user program and evaluation module firmware already resident.
Single step interrupts	Select whether interrupts are permitted.

Table 3: System Configuration Options

For the purposes of the tutorial, ensure the settings are set to their default values.

2. Click the OK button to close the System Configuration dialog box.
3. If communication is successful, the following message will be displayed on the status bar, at the bottom of the HDI window:

Connection complete

Downloading the Tutorial Program

1. Select the [**F**ile -> **L**oad Program...] menu option or click the following toolbar button:



2. The following window is displayed:

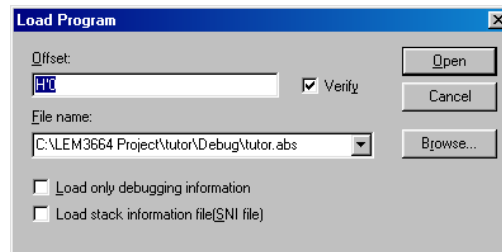


Figure 65: Load Program

3. Browse to the C:\LEM3664 Project\tutor\Debug folder and select the tutor.d20 file.
4. Click the Open button. Several warning messages, similar to the following, will be displayed. These may be acknowledged and ignored:

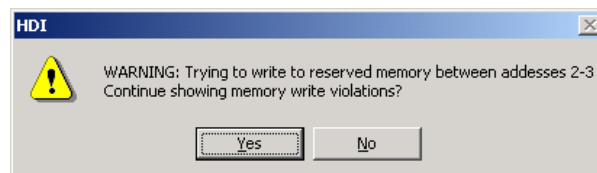


Figure 66: HDI – Reserved Memory Warning

5. After a few moments the following window is displayed:

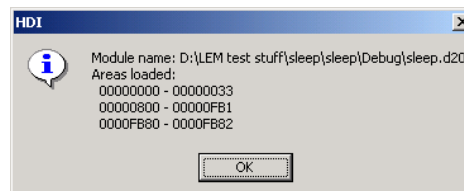


Figure 67: Confirmation of Areas Loaded

6. Click the OK button.

Running the Tutorial Program

Select the [**R**un -> **R**eset **C**PU] menu option, and then select the [**R**un -> **G**o] menu option.

If program execution needs to be verified, attach an oscilloscope to pin 26 (P76/TMOV) and observe the signal being generated from the program.

Viewing the program

Changing the program display

The code window can display source level and purely assembly code. With a C source code window open, click using the right mouse button. From the short cut menu, click Go to disassembly, to view a disassembly of the code.

Setting a Program Counter Breakpoint

With a C source code window open, double-click the BP column, adjacent to the address for which a breakpoint is to be set. The following black marker will appear, indicating a breakpoint has been set and is enabled: •. To disable a breakpoint, double-click the marker, changing its colour from black to red.

Running a Program

To start program execution, select the [**R**un -> **R**eset **G**o] menu option, press the Shift key and the **F5** key, or click the Reset Go toolbar button:



The Go option may also be used, either by selecting the [**R**un -> **G**o] menu option, pressing the **F5** key, or clicking the Go toolbar button:



Note that the program counter must have a valid address. To set the program counter, left-click the desired code line, click the right mouse button and select the [**S**et **P**C **H**ere] menu option.

Running Program to Cursor

A convenient form of running a program is to use the **[Go To Cursor]** command. This is achieved by simply setting the cursor where you want the program to stop. Click the right mouse button with the mouse pointer in the program window and select **[Go To Cursor]** button from the pop-up window menu. Alternatively the **[Run -> Go to Cursor]** menu option, or the following toolbar button may be used to achieve this:



Stopping

When a user program is executing the status bar displays “RUNNING”. To stop program execution select the **[Run -> Halt Program]** menu item, press the ESC key or click the following toolbar button:



Stepping Over a Function

To step over a C function, select the **[Run -> Step Over]** menu item or click the following toolbar button:



Stepping Into a Function

To step into a C function, select the **[Run -> Step In]** menu item or click the following toolbar button:



Stepping Out a Function

To step out of a C function, select the **[Run -> Step Out]** menu item or click the following toolbar button:



Viewing a Trace of Execution

The chip maintains a list of the last 4 branch instructions executed. This trace can be viewed by selecting the [**V**iew -> **T**race] menu item, or by clicking the following toolbar button:



The following trace window will be displayed:

Record	Address	OpCode	Label	Assembler	Valid	Source
0000	00000D38	5470		RTS	*	
0001	00000CE8	40EA		BRA	@ *	
0002	00000CD4	5E000A04		JSR	@ *	c1TurnLED1On();
0003	00000A04	6DF0	c1TurnL	?MOV.W		void c1TurnLED1On(void)
0004	00000A06	6DF1		?MOV.W		
0005	00000A08	6DF2		?MOV.W		
0006	00000A0A	6DF3		?MOV.W		
0007	00000A0C	6DF4		?MOV.W		
0008	00000A0E	6DF5		?MOV.W		
0009	00000A10	6DF6		?MOV.W		
0010	00000A12	7FD47070		?BSET		PDR1 = 0x80;
0011	00000A16	6D76		?MOV.W		}
0012	00000A18	6D75		?MOV.W		
0013	00000A1A	6D74		?MOV.W		
0014	00000A1C	6D73		?MOV.W		
0015	00000A1E	6D72		?MOV.W		
0016	00000A20	6D71		?MOV.W		
0017	00000A22	6D70		?MOV.W		
0018	00000A24	5470		RTS	*	

Figure 68: Trace Window

The instructions marked in the Valid column with ‘*’ are the valid branch instruction held in chip and through which execution is known to have passed. All other instructions – those displayed between valid branches – are interpolated by the LEM software from the known source code information. Note that in some circumstances the interpolated code may not be showing the route taken by the execution between the two branches. In particular it will not show interrupt code.

Looking at Memory

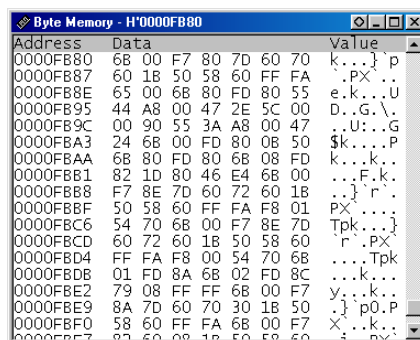
Memory contents may be viewed by selecting the [**V**iew -> **M**emory] menu item, or by clicking the following toolbar button:



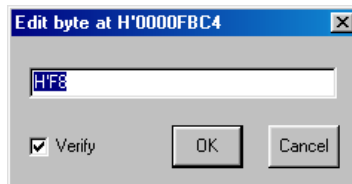
The following dialog box shown will be displayed:

Figure 69: Selecting Memory By Address

The Address entry can be either a pure address or a symbol. A typical memory window with the data grouped as word, and displayed as hex and decimal values is shown below:

**Figure 70: Memory Window**

To edit memory contents, move the mouse cursor to the value you want to change and double-click to display the following dialog box:

**Figure 71: Editing Memory Contents**

Type the new value and click the OK button.

What Else Is There?

The other main windows include the System Status, CPU register and I/O register windows.

System Status

The System Status window details the current setting for the session including target platform, memory usage and events, i.e. breakpoints. Open this window by selecting the [**View -> Status**] menu item or use following toolbar button:



A window similar to the following is displayed:

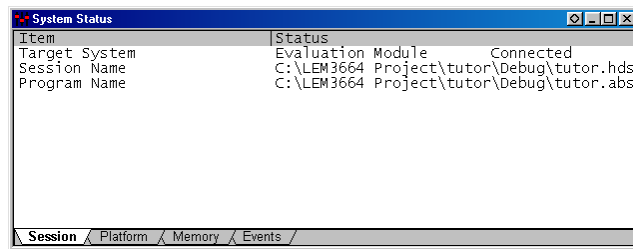


Figure 72: System Status Session Window

Click the Platform tab to display further status information:

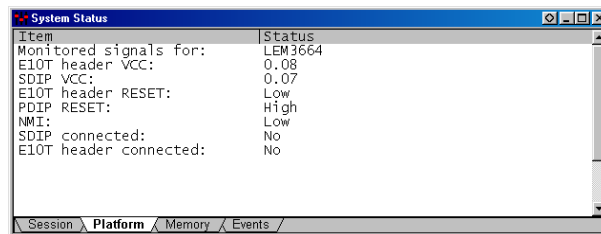


Figure 73: System Status Platform Window

CPU Registers

Contents of the CPU registers can be viewed and amended using this window. Open this window by selecting the [**V**iew -> **R**egisters] menu item or click the following toolbar button:

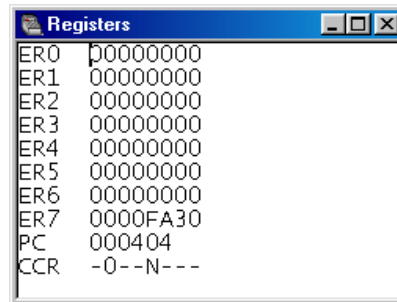


Figure 74: Registers Window

To edit a register, either double-click the register or right-click the register and select the [**E**dit] menu item. The following window will be displayed, allowing you to enter a new value:

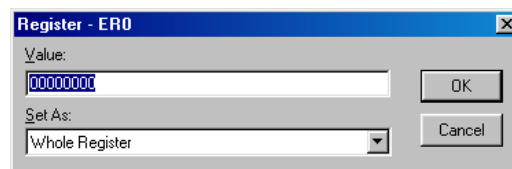


Figure 75: Editing a Register

I/O Registers

Contents of the I/O registers can be viewed and amended using this window. Open this window by selecting the [**V**iew -> **I**/O Area] menu item:

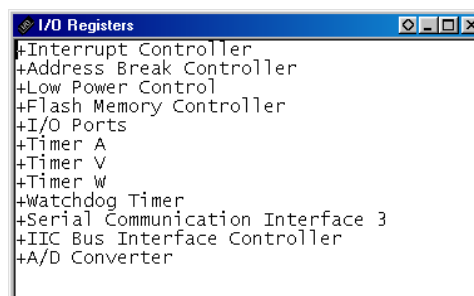


Figure 76: I/O Registers Window

Double-click a device to display its I/O registers:

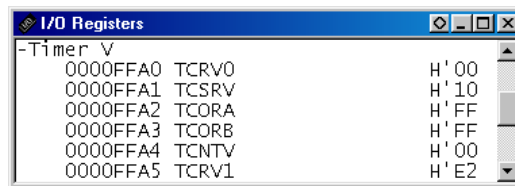


Figure 77: Displaying Register Contents

To edit an I/O register, either double-click the register or right-click the register and select the **[Edit]** menu item. The following window will be displayed, allowing you to enter a new value:

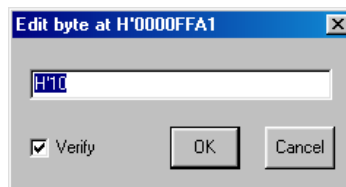


Figure 78: Editing an I/O Register

Summary

The majority of HDI features have been demonstrated in this tutorial. You should now be in a position to use this product to develop your own embedded applications.

6 Menus and Windows

Detailed information on commands and the general HDI functions can be found in the “Hitachi Debugging Interface - User Manual”. Windows specific to LEM3664 are as follows:

Select Session

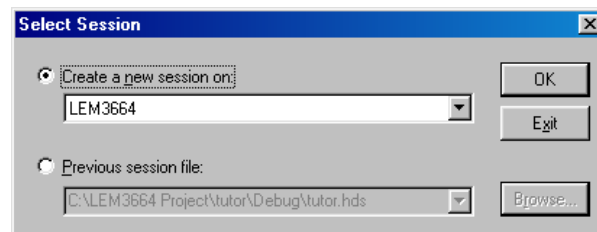


Figure 79: Select Session Window

This window is displayed when the [**F**ile -> **N**ew Session...] menu option is selected. From this window you may choose to create a new session, or load a previously saved session file.

Begin Session

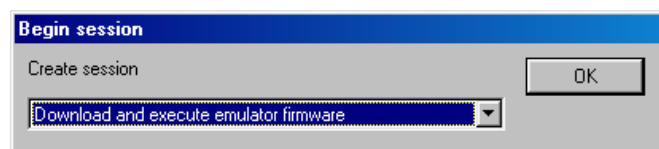


Figure 80: Begin Session Window

This window is displayed when you have chosen to create a new session. Two options are available on this dialog box:



Figure 81: Begin Session Options

If the Download user program option is selected, a further window is displayed:

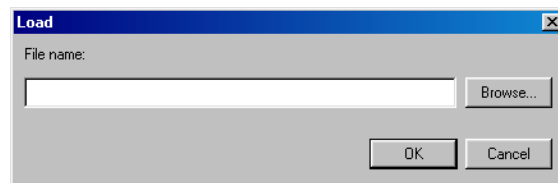


Figure 82: Load a File

This window enables you to specify the name of file to be programmed into the H8/3664, either by typing the name directly or by clicking the Browse button, locating the program file and clicking the Open button. Note that the program file must conform to the Motorola S specification.

System Configuration

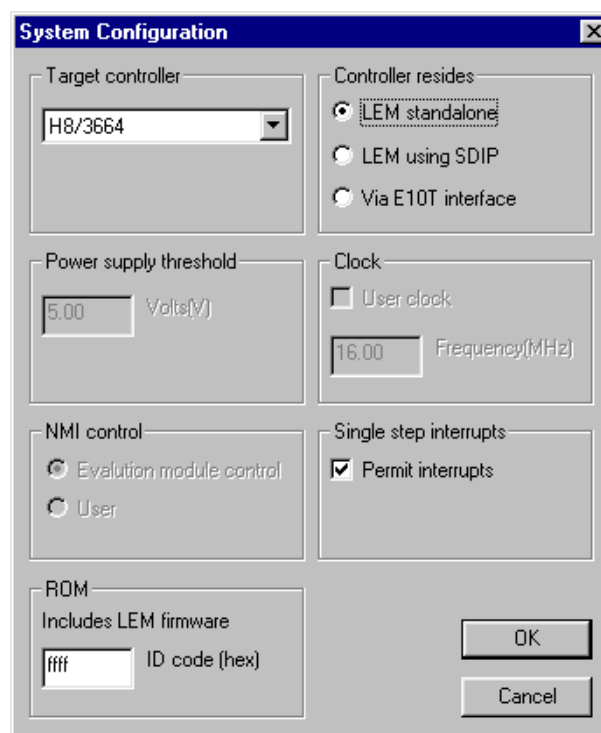


Figure 83: System Configuration Dialog Box

This window is displayed whenever an option is selected on the Begin Session window, or if the [Setup -> **Configure Platform...**] menu option is selected. A full description of the fields available on this window is given in the Tutorial section of this user manual.

Availability of HDI Menu Options

Note that the following HDI menu options are not available when used with the LEM3664:

View menu

- Performance Analysis Window
- Profile-List
- Profile-Tree

Memory menu

- Configure Map
- Configure Overlay

APPENDIX A - Troubleshooting

If the following dialog box is displayed when selecting to create a new session within HDI, check that the USB cable is connected between the PC and the evaluation module:

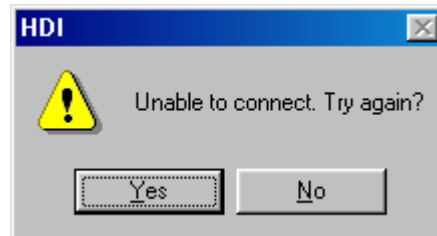


Figure 84: HDI – Unable to Connect

When the cable is connected, click the Yes button to retry communications. When communications has been established, the following dialog box will be displayed:

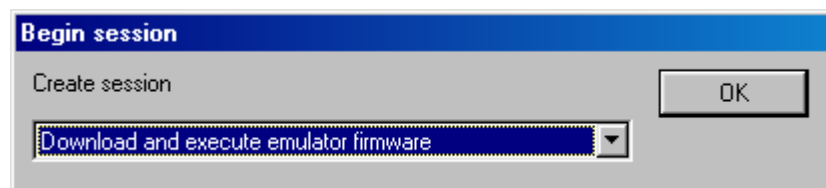


Figure 85: HDI – Begin Session

Select the appropriate option from the list displayed and click the OK button to continue.

Frequently Asked Questions :

1. Stepping over a sleep() instruction causes HDI to run, but pressing the STOP button may cause an error stating that it cannot stop the target. HDI will then go link-down and you must restart the target to get the connection back.
2. Creating a new Session while the disassembly window is displayed and maximised after a program has stopped running may cause HDI to close with an error message.
3. Although loading a Session in HDI will upload the program, pressing GO without first resetting will cause HDI to run into the monitor code, and not your program. Always make sure that you reset and then GO after loading a session.
4. Please note that whitespace in the temp file path in Windows 2000 causes problems. This may occur when compiling your first project. Please check the file names.
5. Stepping through 2 or more instructions when the step rate is set to slow may cause 'Command Not Ready' to be displayed. Increase the rate value in the Step Program Dialog box to overcome this issue.

APPENDIX B - ASCII Code Table

					b7	0	0	0	0	1	1	1	1
					b6	0	0	1	1	0	0	1	1
					b5	0	1	0	1	0	1	0	1
b	b	b	B	MSB/		0	1	2	3	4	5	6	7
4	3	2	1	LSB									
0	0	0	0	0	NUL	DCO	SP	0	@	P	`	P	
0	0	0	1	1	SOM	X-ON	!	1	A	Q	a	q	
0	0	1	0	2	EOA	TAPE	"	2	B	R	b	r	
0	0	1	1	3	EOM	X-OFF	#	3	C	S	c	s	
0	1	0	0	4	EOT		\$	4	D	T	d	t	
0	1	0	1	5	WRU	ERROR	%	5	E	U	e	u	
0	1	1	0	6	RU	SYNC	&	6	F	V	f	v	
0	1	1	1	7	BEL	LEM	'	7	G	W	g	w	
1	0	0	0	8	FE0	CAN	(8	H	X	h	x	
1	0	0	1	9	TAB	S1)	9	I	Y	i	y	
1	0	1	0	A	LF	EOF	*	:	J	Z	j	z	
1	0	1	1	B	VT	ESC	+	;	K	{	k	{	
1	1	0	0	C	FF	S4	,	<	L	\	l		
1	1	0	1	d	CR	S5	-	=	M	}	m	}	
1	1	1	0	E	SO	S6	.	>	N	^	n	~	
1	1	1	1	F	SI	S7	/	?	0	-	o	RUB OUT	